

**Africa Research in Sustainable Intensification for the Next Generation (Africa RISING)**

**West Africa Project**

**Cost and benefit analysis of improved practices for vegetables production under Africa RISING project in Mali**

**Technical report**

1. **Introduction**

Several on-farm trials are being conducted in Southern Mali with the active participation of farmers with the objective of developing agricultural technologies attractive to farmers. The objective of this report is to provide the results of cost-benefit analysis of selected technologies promoted by Africa RISING in southern Mali. Specially, we perform a comparative analysis of costs and benefits of crop trials implemented in the intervention villages in Bougouni and Koutiala districts for vegetable production.

1. **Analysis methodology**

This section is composed of four parts. A first part focuses on the experimental design, the second part on the sampling procedure, the third part presents the method used for the cost and benefit analysis, and the last part discusses results.

* 1. **Experimental design**

The experimental design is based on a comparison of improved and local varieties in terms of yields per hectare. Two improved tomato varieties (Rio de Grange and Roma) and two improved pepper varieties (Yellow and Safi) are compared to the local variety through two agronomic practices including improved and farmer practices. The experimental design is a randomized block where each farmer represents a repetition in each village. In the improved practice, we have 6 lines on an area of 20 m2, with a distance of 0.50 m between the seeding on the same line, and a distance of 0.80 m between two lines on the same plot. Regarding the farmer practice, we have generally 9 lines on a plot of 20 m2 of, with a distance of 0.33 m between the seeding on the same line, and a distance of 0.53 m between two lines on the same plot. Figures 1 and 2 present the two experimental designs for the two practices.

Figure 1: Farmer practice for the tomato production



Figure 2: Improved practice for the tomato production



* 1. **Sampling procedure**

Cost and benefit analysis of technologies promoted by the project uses household survey data. The survey has been carried out in five project intervention villages in Bougouni (Dieba and Madina) and Koutiala (Nampossela, Sirakele, and Zanzoni) districts. The data collection was carried out using a structured questionnaire. The data collected include information about the socio-demographic characteristics of farmers, agricultural inputs, application of improved technologies, production, and prices. Agricultural inputs were mainly seed, compost, urea, cereal complex, NPK, Neem, DAP, pesticide, and workforce. A total of 40 producers have been interviewed.

* 1. **Cost and benefit analysis**

We assess the net benefits using the partial budget analysis. Definitions of some terms and the methods of calculations are described as follows:

* Average yield*:* the yield is the quantity of output produced per unit area. Yield is expressed in kg/ha. The experimental grain yield was adjusted by 10% to approximate the yield that farmers can obtain on their farms. The scaling down is necessary to prevent overestimation of the returns that farmers are likely to obtain from a treatment.
* Output prices: we used farm gate prices to compute returns. The farm gate price of the output is the value (price) farmers receive or can receive for their harvested crops. In other words, it is the price farmers received at the end of the production process.
* Gross return: the gross return is the product of the farm gate price of the output and the adjusted yield. Farm gate prices have been derived from monthly field surveys conducted by the local partners in the intervention villages of Africa RISING.
* Total variable input costs: the total variable input cost is the sum of all variable input costs and varies from one treatment to another. These are farm gate costs of the variable inputs for each of the treatments. Inputs used for the analysis include: seed, labour, compost, urea, complex NPK, pesticide, and workforce.
* Net return*:* net return is the difference between the gross return and the total variable input cost.
* Marginal rate of return*:* is the percent change of net returns as a result of the introduction of the technology. It is the ratio of increased benefits to increased costs which is put in a percentage form.

1. **Results**
   1. **Cost and benefit analysis of chilli pepper production**

The results derived from cost-benefit analysis are provided for the chilli pepper production with farmer practice (FP) and the production with improved practice (IP) at household level (see table below). The results show that the improved practice is more beneficial than the farmer practice for the smallholder farmers of vegetable particularly chilli pepper in Southern Mali. For example, the production of improved variety Yellow with improved practice generates a net benefit estimated to about FCAF 7,007,819 per hectare with the input costs estimated to FCFA 2,858,767 against a net benefit of FCFA 6,963,920 per hectare with the input costs estimated to FCFA 1,748,192 for the farmer practice. The local chilli variety generates a net benefit estimated to FCFA 2,748,707 with improved practice against FCFA 1,728,269 for the farmer practice. Regardless the type of practice used by the farmer, the improved chilli variety is more beneficial than the local variety.

Table 1: Cost-benefit analysis for chilli production with improved and farmer practices

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Chilli pepper** | | | | | |
| **Yellow** | | **Safi** | | **Local variety** | |
| IP | FP | IP | FP | IP | FP |
| Yield (kg / ha) | 9350 | 8050 | 8100 | 7450 | 4400 | 4350 |
| Adjusted Yield (kg / ha) | 8415 | 7245 | 7290 | 6705 | 3960 | 3915 |
| Sale price (FCFA) | 1172 | 1202 | 1162 | 1192 | 1127 | 1152 |
| Gross margin (FCFA) | 9866587 | 8712112 | 8474625 | 7995712 | 4464900 | 4512037 |
| Variable Cost (FCFA) |  |  |  |  |  |  |
| Seed | 275000 | 275000 | 200000 | 275000 | 275000 | 200000 |
| Compost | 1562500 | 1562500 | 1562500 | 1562500 | 1562500 | 1562500 |
| Ploughing | 13000 | 13000 | 13000 | 13000 | 13000 | 13000 |
| NPK Complex | 210929 | 210929 | 210929 | 210929 | 210929 | 210929 |
| Neem | 42129 | 42129 | 42129 | 42129 | 42129 | 42129 |
| Pesticide | 140625 | 140625 | 140625 | 140625 | 140625 | 140625 |
| Workforce | 614583 | 614583 | 614583 | 614583 | 614583 | 614583 |
| Total Cost (FCFA) | 2858767 | 1748192 | 1748192 | 1748192 | 1716192 | 2783767 |
| **Net Profit (FCFA)** | **7007819** | **6963920** | **6726432** | **6247520** | **2748707** | **1728269** |

* 1. **Cost and benefit analysis of tomato production**

The results derived from cost-benefit analysis are provided for the tomato production with farmer practice (FP) and the production with improved practice (IP) at household level (see table below). The results show that the improved practice is more beneficial than the farmer practice for the smallholder farmers of vegetable particularly tomato in Southern Mali. For example, the production of improved variety Rio de grange with improved practice generates a net benefit estimated to about FCAF 33,124,522 per hectare with the input costs estimated to FCFA 1,748,192 against a net benefit of FCFA 24,496,370 per hectare with the input costs estimated to FCFA 1,748,192 for the farmer practice. The local tomato variety generates a net benefit estimated to FCFA 13,457,491 with improved practice against FCFA 10,698,393 for the farmer practice. Regardless the type of practice used by the farmer, the improved tomato variety is more beneficial than the local variety.

Table 2: Cost-benefit analysis for tomato production with improved and farmer practices

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Tomato** | | | | | |
| **Rio de grange** | | **Roma** | | **Local variety** | |
| IP | FP | IP | FP | IP | FP |
| Yield (kg / ha) | 33046 | 24250 | 31171 | 26984 | 14953 | 11968 |
| Adjusted Yield (kg / ha) | 29742 | 21825 | 28054 | 24285 | 13457 | 10771 |
| Sale price (FCFA) | 1172 | 1202 | 1162 | 1192 | 1127 | 1152 |
| Gross margin (FCFA) | 34872714 | 26244562 | 32613574 | 28960980 | 15173683 | 12414585 |
| Variable Cost (FCFA) |  |  |  |  |  |  |
| Seed | 82000 | 82000 | 82000 | 82000 | 50000 | 50000 |
| Compost | 1250000 | 1250000 | 1250000 | 1250000 | 1250000 | 1250000 |
| Ploughing | 13000 | 13000 | 13000 | 13000 | 13000 | 13000 |
| NPK Complex | 210929 | 210929 | 210929 | 210929 | 210929 | 210929 |
| Neem | 42129 | 42129 | 42129 | 42129 | 42129 | 42129 |
| Pesticide | 140625 | 140625 | 140625 | 140625 | 140625 | 140625 |
| Workforce | 9508 | 9508 | 9508 | 9508 | 9508 | 9508 |
| Total (FCFA) | 1748192 | 1748192 | 1748192 | 1748192 | 1716192 | 1716192 |
| **Net benefit (FCFA)** | **33124522** | **24496370** | **30865381** | **27212788** | **13457491** | **10698393** |

# Conclusion

This report performs a cost-benefit analysis of cropping systems for chilli pepper and tomato production under the Africa RSING project in Southern Mali particularly in Bougouni and Koutiala districts using the survey data and the partial budget method. The survey was conducted in 2017 and covered the selected technologies for vegetable production. The results showed that the use of improved practice promoted by the project for the vegetable production is more beneficial than the traditional practice. For example, the gain derived from the production of improved tomato variety with improved practice is 35% higher than that generated by the farmer practice.